

NEURODEVELOPMENTAL PROFILES OF XHOSA SPEAKING CHILDREN IN CONFLICT WITH THE LAW

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DECLARATION

I Anthea Donay Klopper declare that this research report is my own work. It is being submitted for the degree of Master of Science in Medicine in Paediatric Neurodevelopment in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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12 day of October 2011

Dedication

To my long suffering family, thank you for your encouragement and support

Abstract

Objective To ascertain the neurodevelopmental characteristics of Xhosa speaking children from Buffalo City, South Africa, who are on trial.

Hypothesis Delinquent children have a greater prevalence of neurodevelopmental challenges than non offenders.

Design A prospective cross sectional study which uses a series of structured questionnaires in concert with clinical and neurocognitive assessments. Twenty, on trial, males and females, aged between 13 and 17 years old, their parents or guardians and educators were interviewed. The results were compared to general population norms defined by North American populations using Conners' 2TM Rating Scales, STRANDS self reports and PEERAMID neurodevelopmental examination. The Xhosa Senior South African Individual Scale Revised was used for psychometric testing.

Outcome measures Presence of one or more neurodevelopmental disorders including symptoms of attention deficit hyperactivity disorder (ADHD), intellectual disorder and / or neurodevelopmental deficit.

Results Ten percent of participants had a diagnosis of ADHD, both were males. Symptoms of ADHD were identified in 64% of males and 33% of females. Neurodevelopmental challenges were present in 94% (17/18). An incidental finding was high levels of anxiety.

Conclusions The prevalence of an ADHD diagnosis was not higher than the general population, however, the presence of symptoms was high and supported findings in the literature. Neurodevelopmental challenges were present in the majority. Further research is indicated to ascertain the role of anxiety in this population. The development and validation of culturally appropriate assessment tools is a further identified need.

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Abbreviations used in the Report

Abbreviation	Full Text
p-add	Conners' Parent Score ADHD
p-dsmiv	Conners' Parent Score meeting DSM-IV ADHD criteria
p-anxiety	Conners' Parent Score anxiety
p-odd	Conners' Parent Score oppositional defiance
t-add	Conners' Teacher Score ADHD
t-dsmiv	Conners' Teacher Score meeting DSM-IV ADHD criteria
t-anxiety	Conners' Teacher Score anxiety
t-odd	Conners' Teacher Score oppositional defiance
c-add	Conners' Child Score ADHD
c-dsmiv	Conners' Child Score meeting DSM-IV ADHD criteria
c-anx	Conners' Child Score anxiety
PEERAMID	Paediatric Examination of Educational Readiness at Middle Childhood
STRANDS	Survey of Teenage Readiness and Neurodevelopmental Status
Maternal education illiteracy	Maternal education risk if <grade 8
Maternal age	Maternal age when child born <18 high risk
Maternal alcohol	Consumption of alcohol during pregnancy
Maternal smoking	Smoker during pregnancy
Paternal conflict law	Father ever in conflict with law
Paternal alcohol	Paternal alcohol consumption
Paternal not living at home	Father absent
Child hi risk	Perinatal problems present including very low birth weight or prematurity
Child delay	Presence of delayed developmental milestones
Child ill	Presence of epilepsy/meningitis/head injury
Child education	Presence of very early or delayed start to school
Child not with parent	Child not living with either parent

1.0 INTRODUCTION

1.1 Background

In South Africa, the increasing number of children in conflict with the law is a challenge, to the state, educators, parents and health professionals. Studies in the USA and Europe have tried to identify characteristics of these children to establish whether their delinquent behaviour is due to social circumstances and poverty, substance abuse, mental health problems or a number of contributing factors (Junger-Tas, 1994; Stattin, 1996; Moffitt, 1996; Fergusson, 2002; Moffitt, 2002). In the USA, eighteen percent of children younger than 18 years have developmental delay or chronic physical - behavioural - emotional conditions that place them at risk for delay (King, 2003).

The hypothesis is that neurodevelopmental challenges increase the risk of children getting into trouble with the law and thus delinquent children have a greater prevalence of these challenges.

This study seeks to identify neurodevelopmental problems of attention deficit, learning difficulties and cognitive disability using recognised screening tools through a series of interviews and assessments in delinquent children.

The population studied were either residents of a secure institution or part of a programme run by NICRO (National Initiative for Rehabilitation of Offenders). All participants were in the process of court cases and were Xhosa speakers.

In the research report that follows, a literature review examines studies that have investigated this problem and also identifies confounding or contributing factors. The successive chapters cover study design and results, and a discussion with a concluding chapter as the final section.

1.2 Literature Review

Adolescence is a period of dramatic biological, cognitive and psychosocial development (Ford, 1999). Many children reach adulthood without difficulty and yet some engage in activities that may take them on a destructive trajectory.

One of the goals of this study is to take into account the multiple risk factors for child behaviour outcomes by specifically looking at the impact on neurodevelopmental abnormalities. Neurodevelopment is a process that begins at conception and extends throughout the lifespan as neural pathways develop and form. It is observed as an orderly, sequential, progressive and predictable change in abilities, behaviours and activities seen within recognised time frames (Capute, 1996).

The importance of normal neurodevelopment is to obtain normal physical ability and cognitive understanding. The proper development of the physical abilities can be monitored by the milestones that children reach e.g. sitting unsupported. Cognitive ability is assessed by the development of language such as two word sentences and following instructions by a certain age. Both of these complex processes can be altered by a host of factors (Capute, 1996). Adolescent growth and development occurs over multiple domains of function and represents the neurodevelopmental process of maturation. Identifying an individual as having a

neurodevelopmental disorder or delay depends on the definitions used (Levine, 2001a). Parents may pick up abnormalities, noting that their offspring do not follow the normal trajectory of milestones as infants or toddlers. Alternatively, abnormalities may be detected through formal screening by health professionals, while others are more subtle or manifest later with the advent of formal learning (Farmer, 2006). Abnormalities may be detected in any of the domains of motor development, personal social interactions, language and communication, perception, eye hand co-ordination and practical reasoning (Capute, 1996). Emotional and behavioural abnormalities may manifest as primary disorders or as secondary for example, a child with a speech impediment may be teased or bullied and act out violently in retaliation.

Problems created by neurodevelopmental delays and disorders are often complex. Many disabilities are associated with other disabilities, for example; intellectual disability is associated with seizures, cerebral palsy, behaviour disorders and language disorders (Capute, 1996). It is recognised that neurodevelopmental problems are distinct from mental health problems although they may co- exist and this was identified in some studies (Abram, 2003).

1.2.1 Neurodevelopmental challenges

There are many neurodevelopmental challenges, but the conditions considered in this literature review and study are limited to:

Attention Deficit Hyperactivity Disorders (ADHD) (Pratt, 2002; Pliszka, 2003)

The *Diagnostic and Statistical manual of Mental Disorders –Fourth Edition* (DSM-IV, 2000) defines three types of attention deficits: a) an attention disorder characterised mainly by

inattention ; b) an attention disorder characterised mainly by hyperactivity and impulsivity and c) a combined attention disorder characterised by inattention, hyperactivity and impulsivity . It is regarded as one of the most common behavioural disorders in children affecting between 5 and 10% of school age children (Tsal, 2005).

Learning Disabilities (LD) and Intellectual Disability (ID)

There are problems with definitions of learning disability as some researchers loosely use this term to include intellectual disability whereas others identify specific learning deficits such as dyslexia or dyspraxia. Learning Disability is a generic term referring to a group of disorders where there is difficulty in acquisition and use of listening, speaking, writing, reasoning or numeracy. It may occur with other morbidities but is intrinsic to the individual (Hammill, 1990). LD is diagnosed in about 6% of school age children in the USA with twice as many boys than girls affected (Shapiro, 1996).

ID is defined as significant cognitive limitation, a subject having an Intelligence Quotient (IQ,) 2 standard deviations below the mean, typically this is regarded as less than 70 (DSM-IV). ID is frequently associated with other diagnoses such as genetic syndromes and cerebral palsy. (Capute, 1996).

Developmental Coordination Disorder (DCD)

DCD is described in children who exhibit signs of minor neurological dysfunction and this is associated with motor dysfunction. Simple minor neurological dysfunctions may lead to a moderate increased risk for learning problems. Between 5-15% of children experience difficulty in learning movement skills (Rothenberger, 2005). In adolescence, these problems

tend to be with fine manipulation and coordination. The neurodevelopmental assessment used in this study was designed to identify these problems.

Language Disorder

Language delay is often associated with behavioural disorders, ADHD, oppositional disorders and intellectual challenges (Lipkin, 1987; Dekker, 2003). Autism spectrum is sometimes included as a communication disorder although it has distinct DSM-IV criteria.

Language deficits tend to be in conceptualization, comprehension and judgement. This appears to impact self- regulation, social problem solving, moral reasoning and perspective taking (Levine, 2001a).

1.2.1.1 Epidemiology

The World Health Organisation (WHO), estimates that 15-20% of children, world-wide have developmental disabilities (Lipkin, 1996). North American and European data suggest a prevalence of 5-20% of affected children (Kohler, 1987).

Figures for prevalence of developmental disability and delay in South Africa vary according to the definition of disability, between 5-17%. The 2001 census figures suggest 200 000 children under the age of 10 years and 300 000 between 10 and 20 years of age, i.e. 2-3% are affected by disability. This is probably an underestimate (Lansdown, 2002). In a study of 6 692 children in Bushbuckridge, 291 children had at least 1 or more disabilities (Christianson 2002).

1.2.1.2 Causes

There are many factors which have been proposed as causes for neurodevelopmental delay in children.

1.2.1.2.1 Biological Causes

Antenatal factors

Some early stresses have enduring effects (Landgren, 1998). Adversity exerts its effects via many pathways; these may be direct or indirect for example: physical trauma or psychological trauma. Psychological trauma has been shown to alter the patterns of subsequent neurodevelopment (Gorski, 1999). Learning difficulties may result as a consequence of this (Beck, 2005). Antenatal insult with drugs or alcohol, prematurity and low birth weight impact the child's development (Taylor, 2005). Seizure disorders and sensory deficits such as visual or hearing deficits have long-term consequences. A study by Bergvall et al (2006), found an association between restricted foetal growth and low intellectual performance that was persistent and only partly mediated by socioeconomic or familial factors.

Genetic factors

There is an increase in recognition of a substantial genetic contribution to neurodevelopmental problems. Some neurodevelopmental disorders have a clear genetic basis e.g. Williams Syndrome, Down Syndrome etc (Crocker, 1999). Genetic factors may also influence the response to other antenatal factors. A review by Taylor and Rogers (2005) examined early adversity and developmental disorders looking at genetic factors which can alter both the exposure to and impact of environmental adversity. For example, in genetically vulnerable individuals, an abnormality develops with the dopamine transporters during maternal smoking

during pregnancy; an increase in carboxene haemoglobin leads to diminished oxygenation to the foetus and ADHD like behaviour may result (Taylor, 2005).

Birth weight and prematurity

Very low birth weight babies and prematurity, (birth weight less than 1.5kg or less than 29 weeks) have a strong association with future low cognitive ability and they appear to have higher than average behavioural problems (Delobel-Ayoub, 2005). There appear to be structural abnormalities in the hippocampus and characteristic memory impairment (Taylor, 2005). The low birth weight may reflect poor antenatal care, which leads to the low IQ, and a foetus with an abnormal brain is more likely to have had delivery problems. Babies subsequently diagnosed with neurodevelopmental disorders such as intellectual disability, autism, ADHD and developmental co-ordination disorder (DCD) are more likely to have had low birth weight and prematurity. What is not known yet, is the extent to which the neurological alteration is expressed in psychological disturbance (Kunugi, 2001).

Toxins

In South Africa, the major toxin to which the foetus is exposed, is alcohol. Foetal Alcohol Syndrome has well recognised physical signs and the risk for psychological impairment is high. It is a common cause of generalised learning disability, ADHD, deficits in adaptive behaviour and a risk factor for psychiatric disorders (Silberg, 2003). The incidence may be in the region of 2:1000 births (Mick, 2002). Exposure to toxins such as lead, also has an association with decreased IQ (Needleman, 1990). Methyl mercury leads to abnormal brain development and learning disability in later life. A delayed neurotoxicity can manifest many

years after cessation of exposure, with diminished attention, memory and auditory processing (Taylor, 2005).

Infections

Many types of infection during pregnancy may result in neurodevelopmental delay. The effects of congenital rubella syndrome, toxoplasmosis, syphilis, cytomegalovirus and herpes may include microcephaly, intracranial calcification, chorioretinitis, microphthalmia or a combination of these conditions (Hudgins, 1999).

A number of infective causes that develop in childhood, have been identified that lead to neurodevelopmental problems. Increasingly, HIV is recognised as causing developmental delay and encephalopathy (Navarro, 1996). Cysticercosis is endemic in parts of South Africa and the subsequent seizures that a child may experience may lead to developmental problems (Mafojane, 2003). Streptococcal infections have been associated with a number of neurodevelopmental abnormalities as a result of the impact on the basal ganglia, such as obsessional disorders and tics (Heubi, 2000).

Trauma

Severe head injuries in children less than 2 years old may have severe and differing consequences (Schachar, 2004). In accidental and non-accidental trauma associated with post-traumatic amnesia of at least 7 days, there is a disruption of working memory, visio-spatial and visio-motor skills becoming more impaired than verbal skills (Donders, 2006). There is also an association with closed head injuries and ADHD symptoms (Schachar, 2004). There is no

specific brain damage syndrome but a number of individual impairments of functioning are noticed (Taylor, 2005).

Malnutrition

Generalised malnutrition is probably a common cause of major early adversity, particularly within the rural communities of South Africa and may lead to cognitive blunting (Labadarios, 1999). The resulting low intelligence may itself lead to further behavioural problems (Ballabriga, 1990).

More discrete differences are also important in the pathogenesis of neurodevelopmental disorders. Iodine deficiency leading to undiagnosed hypothyroidism in pregnancy has adverse effects on the foetus (Taylor, 2005). Iron deficiency, particularly early on, has later, disadvantageous effects on IQ and school performance (Grantham- McGregor, 2001).

Apart from these biological causes, the environment of the child can also cause neurodevelopmental abnormalities.

1.2.1.2.2 Environmental Causes

Social and familial influences

The context from which children come influences their behaviour, both from a genetic and from a role modelling perspective. This latter contribution may be either protective or may increase the child's risk of neurodevelopmental challenges. In 1979, in the Isle of White study, six risk factors were demonstrated that significantly correlated with childhood disorders.

These factors were: severe marital discord, low social status, large family size, paternal

criminality, maternal mental disorder and foster placement (Rutter, 1985). This was confirmed in subsequent studies where a higher number of risk factors, led to a seven times increased risk of poor academic outcomes (Appleyard, 2005).

Studies have looked at the risk factors and their cumulative effects over time (Fergusson, 2005a). The risk factors have a long term negative impact on children's development, including both increased externalising and internalising behaviour problems, school achievement and cognitive problems. Some studies have looked at pairs of factors associated with child maltreatment, for example maltreatment and inter-parental violence (Ferdinand, 2004). Other studies have looked at the contribution of intergenerational abuse (Dixon, 2005a, 2005b).

Maternal factors

There is a suggestive, although not causal association between psychological distress in pregnancy and the development of ADHD symptoms. The major causative features appear to be a combination of stressful family circumstances, genetic and psychosocial factors (Linnet, 2003). Maternal emotional over-reaction, possibly as a consequence of trauma or harsh treatment, leads to dysregulation of attention in the child. There seems to be a clear effect between pre-term birth, maternal anxiety or depression, which leads to a doubling of risk of behavioural problems at 4 years old (O'Connor, 2002; Taylor, 2005). Maternal depression is one of the strongest family determinants of child health and functioning. Effects include breakdown of maternal-infant attachment, childhood behaviour problems, lower self-esteem and delays in emotional and social development (Zimmer, 2003). Low maternal educational

status, young maternal age and single parenthood are additional risk factors (Appleyard, 2005).

There is a complex interaction between the psychological and social environments and the biological impairment. For example, this is noted to be modified when there is consistency of care, availability of caretaker and the responsiveness of that caretaker to the child's needs (Taylor, 2005). Neglect of children appears to lead to a decrease in inquisitiveness and exploratory behaviour which in turn affects learning and development (Zimmer, 2003). There may also be an association with poor development of self-regulation, impulse control and attention (Dixon, 2005a). It appears that longer periods of deprivation tend to be followed by persisting abnormalities of mental development.

Thus, the biological factors, in addition to temperament and psychopathology and environment may lead to problem behaviours. Many problems often co-exist and we still have a poor understanding of genetic and environmental interactions and correlations. It appears that the timing of exposure in development is a critical determinant of impact; this has been clearly shown in animal studies but application to humans is still unclear. The influence of genetic factors, family factors, social incompetence and negative life events, also increase the risk of psychopathological disorders (Dekker and Koot, 2003b).

1.2.1.3 Consequences

Children with neurodevelopmental challenges are a heterogeneous group at risk for persistent limitations in more than one domain with associated learning disabilities, co-morbidities and

social dysfunction (Pratt, 2002). Complex neurological dysfunction appears to have a strong correlation with developmental and behavioural problems later (Wilson, 2005).

Learning disabilities impair the child's ability in mathematics, expressive written or oral language, reading and comprehension. Depending on the severity of the deficit, the child may be able to mask or compensate for its impact, but with maturation, demands exceed ability and the deficits manifest. These deficits are often combined with attention problems. By the age of ten years, the normally developing child has the ability to focus and sustain attention and deficits in these areas lead to problems with learning (Farmer, 2006). The study by Mayes et al (2000) found 20-50% of children with ADHD have a learning disability and in another study, sixty percent of children with ADHD had school difficulties (Landgren, 2003). In addition, a learning disability and juvenile delinquency have a strong association; in one study, 36% of incarcerated juveniles were found to have a learning disability and youth with learning disabilities were twice as likely to have committed a crime compared to controls (Brier, 1989). If intellectual disability is present the problem is compounded. As intellectual functioning decreases the detrimental impact on academic, social and emotional functioning increases (Pratt, 2002).

Neurodevelopmental disorders such as ADHD are associated with a number of co-morbidities such as conduct disorder, oppositional defiance disorder, depression, mania and anxiety. Co-morbidity increased the risk of deviant, emotional and behavioural problems by three to four times (Dekker, 2003a). In children with a lower IQ there is an association with psychotic, self absorption and autistic behaviours (Dekker, 2003b).

Severe hyperactivity is a strong predictor of poor psychosocial adjustment. These children are more prone to accidents, psychiatric problems in adolescence, educational and occupational failure and fewer satisfactory relationships (Taylor, 1996). A longitudinal study by Fergusson et al (2005b) examined the role of intelligence in longer term educational achievement and social adjustment. Their conclusion was the association between early intelligence and later social adjustment was mediated by childhood conduct problems and family social circumstances.

An individual's experience of adolescence is influenced by cultural context and environmental factors. Shifts in family composition, schools and peer culture all impact the experience. In addition, the maturation process taking place occurs at different rates in different domains so that a physically mature and cognitively immature adolescent may be more vulnerable to peer pressure and impulsive risk taking (Ford, 1999). Adolescence is a period of increased individuation, metacognition and impulsivity, and problems with neurodevelopment may lead individuals into trouble, with parents, school and the law (Ford, 1999).

1.2.2 Juvenile Delinquency

Juvenile delinquency is a legal term applied to the illegal or criminal behaviour by those who are not yet considered adult (Dusek, 1996). In South Africa, a juvenile is defined as someone under the age of 18 years old. The juvenile is treated differently to adults within the legal system, for example the offender's name is not published in the press.

1.2.2.1 Epidemiology

There is a dearth of accessible statistical data in South Africa regarding the prevalence of juveniles breaking the law. It was estimated that more than 170 000 children were arrested in 2001 mostly for property offences such as theft (Muntingh, 2003). The police statistics for years 1999 through to 2001 showed an annual average of 11282 juveniles arrested in the Eastern Cape, about 9% of the national total. Only 28% of the juveniles arrested were female (Muntingh, 2003).

1.2.2.2 Causes

Delinquency is caused by multiple determinants that work in combination. These include individual challenges, parental influences and peer group influences.

Individual Challenges (Loeber, 1983, 1990)

Biological Challenges: The individual may have a number of inherent factors that predispose to delinquency. Peri-natal complications may lead to neurological impairment in the frontal lobes, which in turn affects primary executive function. This leads to a deficit of and problems with impulsivity, verbal expression and an understanding of societal norms. In an environment where there is deficiency in shaping and modelling pro-social behaviours, this may set a child up to fail, both in relationships with his peers and at school. As a result of this complex interaction of factors, anti-social behaviours may then result.

Psychological Challenges: There is a large body of research on the development of conduct problems in childhood. Most of these have explored the psychopathological characteristics of

children in conflict with the law rather than neurodevelopmental deficits *per se* (Abram, 2003; Ford, 2003; Harrington, 2005). An examination of the prevalence of DSM-IV Disorders in the United Kingdom demonstrated an incidence of 9.5% in the general adolescent population and in the USA one in 12 adolescents suffer from mood disorders (Ford, 2003; Ryan, 2004).

Juvenile offenders have prevalence rates of DSM-IV disorders of between 17 and 78 percent (Ryan, 2004). Children with ADHD often have a negative mood (Barkley, 1981). The research suggests that children with conduct problems in childhood will develop abnormal psychosocial functioning as adolescents and that crime, substance abuse, mental health problems and multiple sexual relationships may be the outcome (Mason, 2005). Conduct disorder in delinquent juveniles has a high correlation with police or judicial contact (Ferdinand, 2004).

There appears to be a developmental progression from early conduct problems to later substance abuse i.e. the former predisposes to the latter. Alcohol is the most frequently used substance amongst adolescents. Types of adolescent alcohol use, range from problem drinking, to heavy drinking to those who abstain or drink occasionally. There is also a strong association with conduct disorder, aggression and delinquency in children who use alcohol (Steinhausen, 2003). ADHD is often associated with increased tobacco and alcohol use which promotes vulnerability to nicotine dependence, peer deviancy and conflict with the law (Daley, 2004).

The research methodology used by these researchers included self report surveys which identified internalising behaviours such as depression and anxiety as well as defiant behaviour variables. Most of the studies quoted relied on self-report from the adolescents. Most of the studies were cross sectional in nature although two used birth cohorts and twenty five year

longitudinal studies (Fergusson, 2005a, 2005b). All the studies identified related social, familial, individual, genetic and other correlates which led to conflict with the law. A criticism is that these studies often focus on a single end point (i.e. one diagnosis) which, with regard to development issues, may obscure some of the pervasive effects. A strength of some of the studies, is that reports from multiple informants were used which gave better predictive validity (Vermeiren, 2004). Some of the studies included females and examined the differences between genders (Ryan, 2004). In South African studies, genetic factors appear to play a strong role in females who abuse substances and / or suffer with depression. In males, the environment i.e. family dysfunction and deviant peer groups, has a greater influence and genetic factors appear to be limited to tobacco and alcohol use (Wild et al, 2004). A weakness of some of the studies was that the different tools used only identified psychopathological problems and some studies compared different tools (Ferdinand, 2004). The individual factors for each child can be further affected by the environment in the home.

Parenting and Family Factors

Prediction of anti-social behaviour in middle childhood, from a biosocial model, has been explored in a number of studies and a combination of negative factors, such as peri-natal complications in the presence of rejecting parenting and family adversity, leads to a number of anti-social behaviours (Petrus, 2004; Beck, 2005).

Intergenerational continuities (three generations) in anti-social behaviours have been shown in the Cambridge Study in Delinquent Development (Smith, 2004). Parenting patterns play a role in these continuities, for example, parental conflict and authoritarian parenting were related to early childhood conduct problems.

Poorly supervised fathers became poor supervisors as fathers. Assortative pairing appears to take place in that anti-social males tend to partner anti-social females. A comprehensive review of studies of family impact on delinquency concluded that family criminality was one of four important categories of family influence consistently found in the literature. A criminal father appears to predict the likelihood of delinquency and this seems to be independent of the other three categories of poor school performance, other family disruption and poor child rearing (Loeber 1983; Dixon, 2005b). The Cambridge study in Delinquent Development also demonstrated continuity in bullying between generations of parents and children (Dixon, 2005b). Offending is transmitted from one generation to the next and it appears to be strongly concentrated in families. Even if parenting itself is not learned and is transmitted across generations, it is likely that socialisation practices and in particular, inept parenting influence and interaction with biological factors and social environments. These are then translated into anti-social behaviour in children. Parenting that is harsh or abusive; where there is poor supervision, inconsistent discipline, parental conflict and lack of affection and support, clearly have negative factors (Fagan, 2003; Smith, 2004). Absent or anti-social fathers appear to impart a genetic risk as well as exacerbating difficulties encountered by single mothers trying to cope alone with the burden of income stability etc. Negative parenting practices, in particular parental rejection, are a major risk factor for delinquent behaviour (Barnow, 2004).

One of the other causative relationships is the association between self-esteem and risk behaviours. In a study by Wild, (2004) family self-esteem was the strongest indicator in terms of behaviour. A low family self-esteem led to multiple risk behaviours in males and females; a low body image and global worth was uniquely associated with risk behaviours in females but not males.

Family violence in childhood appears to have a direct effect on delinquency in females but failed to account for problems in males (Becker, 2002). Human aggression caused by early exposure to violence in the home is a result of violence being a part of relationships and seen as an acceptable way to assert views or resolve conflicts and becomes an acceptable method to discharge stress (Pratt, 2003). Finally the effect of the peer group outside of the home cannot be discounted.

Peer Group Influence

The role of peers is influenced by the parenting role so that a harsh, rejecting parenting style tends to lead to greater susceptibility to peer pressure. The individual also often develops an aggressive interpersonal interaction style that leads to rejection by some peers, and may lead to friendships with other adolescents in a similar situation (Gold, 1980).

The interpersonal relationships that develop between peers, influence choices that impact behaviour of teenagers. Social associations may have a positive or negative influence such as introduction to gang culture. There is increasing research demonstrating the correlates of individual behaviour and practices with anti-social and adverse outcomes that include crime, substance abuse, school difficulties, mental health problems, suicidal behaviours, unemployment, teenage pregnancy etc. (Dube, 2001; Fergusson ,2005a; Greydanus, 2005).

An increased risk for drug taking appears to arise from delinquent peer groups. It may be that an emotionally distressed or inhibited person may come to use drugs or alcohol as a way of relieving their negative mood. That is, they self-medicate. An associated risk factor is

parental depression and thus a higher risk of substance abuse is seen as a mixture of environmental and genetic interactions (Silberg et al, 2003).

Young children who are violent, are more likely to grow up to be violent as adolescents and adults. Violent behaviour occurs as a result of a confluence of multiple factors and pathways. There is an increased risk of severe and persistent mental illness during childhood and an association with neurological impairment, psychoses and head trauma (Schachar, 2004). There may be an association with gang membership and rite of passage (Greydanus, 2005). Youth who commit serious violent crimes are a distinct group of offenders who are substantially different from the typical juvenile involved in delinquent conduct.

1.2.3. Assessment of Psychopathological and Neurodevelopmental Disorders in Adolescents

Neurodevelopmental disabilities and psychopathology often co-exist as do juvenile delinquency and psychopathology (Brier, 1989; Becker, 2002; Dekker, 2003; Ford, 2003; Fergusson, 2005a). The dilemma arises that psychopathological disorders cannot be completely excluded in a study of this nature. There is a difference between a clinical diagnostic approach which reaches a consensus by experts that a diagnosis is either absent or present (but does not distinguish between severity or the range of symptoms) versus the empirical quantitative approach which tends to use rating scores and gives information regarding number of symptoms and severity. None of these approaches fully satisfies the assessment and diagnosis of child psychopathology or neurodevelopmental challenges. These factors were taken into account when developing this study which tried to use both paradigms.

Most previous studies had limitations in terms of generalisability. This related to the types of study; most were cohorts of volunteers or adolescents committed to institutions. There were wide variations in sampling in measurements and in diagnostic criteria. As there are difficulties making a firm diagnosis, mental health problems, *per se*, were excluded. These international studies thus cannot be generalised to the South African juvenile delinquent population.

A criticism of some of these studies is that only a single outcome or risk factor was identified. This approach is simplistic as it does not reflect the co- existence of multiple adversities. There appears to be a cumulative risk in child behaviour outcomes; the more risks present, the worse the outcome for the child. Thus, a low social socio-economic status with high parental stress, family disruption and inter-parental violence in early and middle childhood have more negative outcomes. The timing of insult was also deemed to be an important factor with early childhood being the most vulnerable period (Taylor, 2005). However, this was difficult to quantify within this study. Some authors have stated that poverty, insurance status, family discord or violence and the health status of adults within a family are more common determinants of a child's developmental status than the presence of biological disease (Pratt, 2003).

This research report takes into account the negative and positive family influences through the use of demographic questionnaires. A number of contributory factors appear to cause the neurological deficits that lead to neurodevelopmental problems. Many of these confounding factors were ascertained in the child health questionnaire used in this study. Some studies have looked at isolated factors within the delinquent population such as executive function,

verbal deficits or range of neurodevelopmental constructs. Findings are often inconclusive (Teichner, 2000). A neurodevelopmental examination in one study identified that 18% of delinquents (versus 4% of controls) had deficits in more than two domains (Karniski, 1982).

South African research in this area is limited; the most recent, at the time of this study, looked at adolescent risk behaviours and self esteem. It identified low self esteem as a contributor to risk behaviours which included early sexual experience, substance abuse etc. (Wild, 2004).

There are no studies devoted to the neurodevelopmental profiles of juvenile delinquents in South Africa. Therefore the aim of this study was to identify neurodevelopmental challenges experienced by juvenile delinquents in the Eastern Cape and to compare these challenges with those of the international literature. Multiple risk factors were assessed.

2.0 METHODS

A prospective, observational cross sectional study was performed. The study took several months to complete. In order to identify developmental deficits, a number of different questionnaires and perspectives were used.

2.1 Sample

The subjects were all in the court process and they were either referred by the NICRO social worker or by the state social worker at the detention unit, to the project as they entered the judicial system to await trial after being charged with various offences. An explanation of the research was given to groups of offenders and their parents by the researcher via an interpreter explaining the purpose of the study and outlining the roles and expectations of the participants. They were included in the study unless they or their parents /guardians declined. The subjects were all volunteer adolescents.

Adolescents over the age of 18 and younger than 12 years old were excluded.

All subjects were on trial for a range of non- violent offences including car theft, shop lifting and attempted " minor" assault. Violent offenders were excluded.

2.2 Site of the study

The subjects were from Buffalo City in the Eastern Cape They were either committed to a residential detention facility (John X Merriman detention centre) or committed to probationary care and enrolled in a programme facilitated by NICRO (National Institute for Crime

Rehabilitation). The interviews and examination took place either at the detention centre in a room set aside for this purpose or at NICRO sites in East London and Mdantsane as these were accessible to the participants.

The sample aimed initially to reach a minimum of 32 children. The high drop out rate resulted in a final sample size of 20.

The trials were ongoing and the children were either committed by the court to the NICRO programme or committed to NICRO pending trial and sentencing. The children in detention were there predominantly due to concern with regard to absconding during the trial.

2.3 Procedures

A presentation was done by Xhosa speaking research assistants on the outline of the research to the offenders and their parents. This was done through a series of four groups of NICRO programmes. Volunteers were requested from this pool. Both parents and participants had to agree to participate. A letter outlining the research was written to each of the parents and the adolescents; the letters confirmed confidentiality and anonymity of results. The parents were also offered the results of their child's individual scores. The children in the residential detention facility were approached directly. Parental consent was then elicited telephonically where possible. Tracing of participants' parents was attempted and letters posted to them or visits by research assistant to obtain consent in all other cases.

Trained survey administrators used a standardised translation of the tools. The American publishers of the tools declined to give permission for full translations to be available to the participants as they felt the study was too small. The following process was used for all participants:

1. The offenders completed the responses on the questionnaires as the administrators read the questions to them.
2. Parents were interviewed separately by the trained survey administrators and completed the surveys and questionnaires.
3. The offenders were then invited to a separate appointment for neurodevelopmental assessment by the researcher.
4. Psychometric testing by a Xhosa speaking intern psychologist was then performed on half the sample of offenders.
5. A letter was sent to teachers of the children, which did not reveal the aspect of conflict with the law, and requested them to complete a questionnaire

Each of the subjects was assured that they could withdraw at any stage and without penalty further affecting the overall rate of attrition. Confidentiality of the all the responses was assured. On each occasion, the transport costs of the participants were covered to support higher rates of adherence to the study protocols.

2.4 Instruments (Appendix 2)

Instruments were selected on the basis of literature reviews identifying the most appropriate for the purposes required (Conners, 2001; Levine, 2001; Collett, 2003). No single tool identified all the neurodevelopmental challenges, and so a variety were selected that gleaned information from a number of sources in order to increase reliability.

All the instruments were translated into isiXhosa and facilitated by trained survey administrators. The translation of all the scales into isiXhosa followed established guidelines, including the appropriate use of back translations. The translation into isiXhosa was made by two independent parties followed by discussion of the translated questionnaires with other isiXhosa speakers who then commented and did a back translation into English. These were compared with the original English translation to ensure fidelity to the tool. Each survey administrator had a copy of the isiXhosa translation and the English original to further augment the accuracy of the survey.

The interviews and neurodevelopmental assessment were carried out on the same day at one of the sites when possible. It was sometimes necessary to do the interview and examination over two separate sessions. The psychometric testing was performed on a separate day by mutual arrangement with the psychology intern and participant.

Each child subject completed the Conners-Well's Adolescent Self Report Scale: (Long Version CASS:L). They also completed the survey of Teenage Readiness and Neurodevelopmental Status (STRANDS) developed by S R Hooper PhD and Melvin D Levine

MD. This is an assessment tool that uses the adolescents' evolving meta-cognitive abilities to correlate findings of attention deficit. It is a multidimensional student completed questionnaire using a Likert scale. This in itself is not diagnostic, but gives supportive information to the Conners' self- assessment. It asks them about their own perceptions of how they are functioning across a variety of neurocognitive and psycho-social domains. The STRANDS consists of two components: a structured student interview and a self- administered student questionnaire. In a pilot study it was discovered that the student interview was too advanced and difficult for the subjects to complete so only the student questionnaire was used. The subjects report on how they perceive five key areas of their lives: school skills, school life, social life, school preferences, work preferences and reasons thereof. They are asked to offer explanations that help to inform the reasons for school performance, either positive or negative. This only requires a low level of reading therefore little assistance was required from the survey administrators.

The parent/guardian was asked to complete the Conners' 2TM Parent Rating Scale Long Version (CPRS-R:L). The main use of the Conners' Rating Scales Revised is the assessment of Attention Deficit Hyperactivity Disorder however it has a broader scope as it contains sub scales for the assessment of conduct, cognitive, family, emotions, anger control and anxiety problems.

The parent/guardian also completed a demographic questionnaire that included a history of the social background of the parents of the subject and the subject's medical and developmental history.

The neurodevelopmental examination utilised The Paediatric Examination of Educational Readiness at Middle Childhood PEERAMID 2. It was developed for urban American children between the ages of 9-15. The assessment allows for adjustment within different cultural groups and it was felt that extending the age range of use was not inappropriate. (Levine, 1993) This is a standardised examination where the following domains were assessed:

- Fine motor/graphomotor functions.
- A modified language function examining category naming and picture parts naming assessing phonology, word retrieval, expressive fluency, semantics and active working memory. The full language function was omitted for practical reasons as an appropriate Xhosa translation was not available.
- Gross motor function assessing praxis somesthetics input, motor sequencing, motor inhibition and rhythmicity. Motor memory, eye hand coordination and visual spatial awareness were included.
- Memory function measuring sequential memory, retrieval, active working memory, sentence comprehension, visual registration, short term memory, auditory registration, planning/organisation.
- Visual processing functions which assessed dominance, visual spatial awareness, memory functions, sentence comprehension, graphomotor control, visual motor integration, visual spatial awareness, short term memory, planning and organisation.

This was conducted by the researcher who is trained in the use of the neurodevelopmental examination and tools.

Psychometric assessment was performed by 3 Xhosa speaking psychology interns under supervision. The Xhosa Senior South African Individual Scale- Revised (XSSAIAS-R) published by the Human Sciences Research Council was used. This is a recognised and much utilised tool within the South African context. The validity and reliability of this instrument has been documented with an age appropriate norm for each scale. It provides verbal and non-verbal scores as well as an overall IQ score. This study has defined intellectual disability as those children with cognitive deficits or intelligence quotient of 70 or less. Learning disability refers to specific learning deficits.

The educator was asked to complete the Conners' 2TM Teacher Rating Scale Long Version (CTRS-R:L).

2.5 Data Analysis

The outcome of the assessments was to give profiles of individuals and then measure the significance of various factors impacting on that individual with regard to their subsequent offending. Neurodevelopmental profiles were created for each participant. They were then analysed for the presence of deficits which could be categorised as either a diagnosis (according to DSM-IV criteria) of Attention Deficit Disorder, or developmental delays. Gender differences were also analysed.

The incidence of neurodevelopmental problems was then ascertained within this small sample.

The data was analysed using 2x2 contingency tables comparing binary outcome variables.

Diagnosis of ADHD: The data was summarised using mean, sd, percentages and confidence intervals.

The demographic data was also examined to check for associations that predisposed participants to neurodevelopmental problems or that could be perceived as confounding variables. The use of different assessment tools also allowed for comparisons between different modes of detecting problems. Identifying strength of association between constructs, employed Fisher's exact test.

Diagnosis of Intellectual Disability or Learning Disability was compared using the results of PEERAMID and XSSAIS-R.

The statistical package Stata (Stata Corporation, College Station, TX, USA) was used.

3.0 RESULTS

Data was analysed for a total number of twenty participants. If only one component of the data was missing, the information on that participant was included. The gender breakdown: 70% were male and 30% female. The age range was between 13 and 17 years old. Eight participants were 13 to 15 years old and the remainder were 16 to 17 years old. The mean age was 15.5 years. Four of the participants had not progressed beyond grade four, one was in grade seven and the remainder were in high school.

A summary of the neurodevelopmental profiles and demographics is in Appendix 1.

3.1 Diagnosis of Neurodevelopmental Challenges

Attention Deficit Hyperactivity Disorder (ADHD)

Table 3.1 Mean Scores of Selected Conners' Results (see legend)

1	2 Score	3 Mean (sd)	4 N over 60	5 Confidence Interval
Parent	p-add	67.60 (15.32)	9/15	59.11 ; 76.09
	p-dsmiv	65.07 (14.15)	9/15	57.23 ; 72.90
	p-anx	76.33 (13.03)	13/15	69.12 ; 83.56
	p-odd	58.27 (16.00)	6/15	49.41 ; 67.13
Teacher	t-add	64.50 (14.39)	7/12	55.35 ; 73.65
	-dsmiv	66.17 (15.87)	6/12	56.08 ; 76.25
	t-anx	67.84 (14.84)	8/12	58.41 ; 77.26
	t-odd	60.42 (14.74)	6/12	51.05 ; 69.78
Child	c-add	55.4 (9.43)	9/20	50.99 ; 59.81
	c-dsmiv	49.7 (8.16)	4/20	45.89 ; 53.52
	c-anx	53.3 (8.69)	3/20	49.23 ; 57.34

Results from parent, teacher and child surveys show the mean for each subset of results for selected items: symptomatic ADD, a DSM-IV diagnosis of ADD, oppositional defiance

disorder (ODD) and anxiety. N over 60 indicates the number of children in each category who were symptomatic i.e. had a T score of over 60.

Abbreviation	Full Text
p-add	Conners' Parent Score ADHD
p-dsmiv	Conners' Parent Score meeting DSM-IV ADHD criteria
p-anxiety	Conners' Parent Score anxiety
p-odd	Conners' Parent Score oppositional defiance
t-add	Conners' Teacher Score ADHD
t-dsmiv	Conners' Teacher Score meeting DSM-IV ADHD criteria
t-anxiety	Conners' Teacher Score anxiety
t-odd	Conners' Teacher Score oppositional defiance
c-add	Conners' Child Score ADHD
c-dsmiv	Conners' Child Score meeting DSM-IV ADHD criteria
c-anx	Conners' Child Score anxiety

The self- report does not include scores for oppositional defiance.

Conners' T score criteria state that a score of over 60 means that a symptom is present and impacting on the context in which it is measured (home or school). For a DSM- IV diagnosis of ADHD, scores must be over 60 for both parent and teacher within the domains of inattention and or hyperactivity/ impulsivity (Conners, 2001).

The number of participants who met the symptom criteria for ADHD was 60% (9/15) for parent score and 50% (6/12) for teacher score.

The individual profiles demonstrated that only two males (10% of sample) met the full criteria (both parent and teacher scores were over 60) for a DSM-IV diagnosis of ADHD. No females met the DSM-IV diagnostic criteria although 16% were symptomatic.

Typically, self-assessment by adolescents does not usually identify attention deficit, however five subjects identified symptoms with one correlating with the parental and teacher assessment. Four females identified attention deficit symptoms, one with attention deficit and DSM-IV criteria.

Co-morbidities often associated with attention deficit are anxiety and Oppositional Defiance Disorder (ODD). Of those participants who had symptoms of attention deficit, 50% (9/18) also demonstrated some degree of anxiety within the home context and 28% (5/18) within the context of school. ODD was identified by parents in 40% (6/15) and teachers identified 50% (6/12) as having ODD. The ODD is a risk factor for conduct disorder which is in turn associated with delinquency.

The STRANDS identified 40% (8/20) of the children with a self- assessment diagnosis of ADHD. A total of 36% (5/14) of boys and 50% (3/6) girls demonstrated predominantly high external locus of control which is consistent with ADHD.

Diagnosis of other neurodevelopmental challenges

The neurodevelopmental assessment was completed with eighteen out of twenty candidates being assessed. The total PEERAMID score indicated that seventeen out of eighteen participants (94.4%) were below average compared to North American populations (the control). When the scores were broken down to categories, below average scores were found for seventeen out of eighteen for fine motor, language and memory. All identified above average gross motor skills. Visual perception: thirteen out of eighteen were below average.

The Xhosa SSAIS-R was performed on half the cohort, i.e. ten students were assessed. Three students were identified as having scores of 90 or less. The Xhosa SSAIS-R identified one participant as borderline intelligence with an IQ of 76.5. This may indicate a mild intellectual disability.

3.2 Individual and Environmental Risk factors identified

Characteristics of the study group were analysed to ascertain the family or environmental risks that would predispose to neurodevelopmental challenges. Individual risk factors were also identified. These risks were ascertained from the full battery of tests and questionnaires used.

Maternal risk factors: 44% of mothers had low levels of education, a recognised risk factor in child well-being. However this was not significant in this study. Very few mothers were under the age of eighteen when their children were born and very few drank or smoked during pregnancy.

Paternal risk factors: most children were not living with their fathers (80%). However the significance on a diagnosis of ADHD was not apparent. One father had a criminal record.

Parental risk factor variability: One father and four mothers were known to be deceased. Within our research cohort 45% (9/20) did not live with either parent.

Child factors: 23 % had a history of high risk birth either low birth weight or prematurity. No children had developmental delay in reaching milestones but 73% had disruption in schooling either starting very young or later than eight years of age or repeating grades. Four participants (20%) had not progressed beyond grade 4 at the time of testing.

Table 3.2 Proportion at Risk of Neurodevelopmental Challenges Based on Full Battery of Tests

Proportion at Risk	At Risk (%)	95% Confidence Interval
PEERAMID	94.4% (17/18)	72.71 ; 99.86
Strands	40% (8/20)	19.12 ; 63.95
p-add	60% (9/15)	32.29 ; 83.66
p-dsmiv	60% (9/15)	32.29 ; 83.66
p-anx	86.7% (13/15)	59.53 ; 98.34
p-odd	40% (6/15)	16.33 ; 67.71
t-add	58% (7/12)	27.67 ; 84.83
t-dsmiv	50% (6/12)	21.04 ; 78.91
t-anx	66.7% (8/12)	34.89 ; 90.08
t-odd	50% (6/12)	21.09 ; 78.91
c-add-	45% (9/20)	23.06 ; 68.47
c-dsmiv-	20% (4/20)	05.73 ; 43.66
c-anx-	15% (3/20)	03.21 ; 37.89
Maternal education illiteracy	41.2% (7/17)	18.44 ; 67.08
Maternal age	7.7% (1/13)	00.19 ; 36.03
Maternal alcohol	6.7% (1/15)	00.17 ; 31.95
Maternal smoking	13.3% (2/15)	01.66 ; 40.46
Paternal conflict law	11.1% (1/9)	00.28 ; 48.25
Paternal alcohol	35.7% (5/14)	12.76 ; 64.86
Paternal home	80% (12/15)	51.91 ; 95.67
Child hi risk	23.1% (3/13)	05.04 ; 53.81
Child delay	100% (12/12)	0 ; 26.48
Child ill	26.7% (4/15)	07.79 ; 55.10
Child education	73.3% (11/15)	44.90 ; 92.21
Child parent	45% (9/20)	23.06 ; 68.47

The proportion of children at risk for a diagnosis of neurodevelopmental challenge resulting from family influences or other risk factors.

Abbreviation	Full Text
PEERAMID	Paediatric Examination of Educational Readiness at Middle Childhood
STRANDS	Survey of Teenage Readiness and Neurodevelopmental Status
p-add	Conners' Parent Score ADHD
p-dsmiv	Conners' Parent Score meeting DSM-IV ADHD criteria
p-anxiety	Conners' Parent Score anxiety
p-odd	Conners' Parent Score oppositional defiance

t-add	Conners' Teacher Score ADHD
t-dsmiv	Conners' Teacher Score meeting DSM-IV ADHD criteria
t-anxiety	Conners' Teacher Score anxiety
t-odd	Conners' Teacher Score oppositional defiance
c-add	Conners' Child Score ADHD
c-dsmiv	Conners' Child Score meeting DSM-IV ADHD criteria
c-anx	Conners' Child Score anxiety
Maternal education illiteracy	Maternal education < grade 8
Maternal age	Maternal age when child born <18 high risk
Maternal alcohol	Consumption of alcohol during pregnancy
Maternal smoking	Smoker during pregnancy
Paternal conflict law	Father ever in conflict with law
Paternal alcohol	Paternal alcohol consumption
Paternal not living at home	Father absent
Child hi risk	Perinatal problems present including very low birth weight or prematurity
Child delay	Presence of delayed developmental milestones
Child ill	Presence of epilepsy/meningitis/head injury
Child education	Presence of very early or delayed start to school
Child not with parent	Child not living with either parent

The wide confidence intervals are a feature of a small study sample.

3.3 Specific Risk factors for ADHD

The characteristics of the study group were further analysed to establish whether the specific risk factors that predispose to ADHD were present in this group.

There were no significant differences in family factors between children with ADHD versus those with no ADHD symptoms. One participant had epilepsy and three participants had a history of meningitis. These illnesses predispose to learning difficulties and ADHD but did not reach significant levels.

Table 3.3 Factors Associated with ADHD Symptoms

Construct	ADHD	ADHD Symptoms Present		Fishers Exact Test p Value
	Absent	1 Context	2 Context	
Mat education illiteracy	40% (2/5)	44.4% (4/9)	0	0.790
Maternal age <18	25% (1/4)	0 (0/8)		0.333
Maternal alcohol	0 (0/5)	12.5% (1/8)	0	1.000
Maternal smoker	0 (0/5)	25% (2/8)	0 (0/1)	0.560
Paternal conflict law	100% (4/4)	100% (4/4)		
Paternal alcohol	20% (1/5)	57.14% (4/7)	0/1	0.402
Paternal not living at home	60% (3/5)	100% (8/8)	100% (1/1)	0.253
Child risk	40%(2/5)	16.7% (1/6)	0 (0/1)	0.659
Child ill	20% (1/5)	25% (2/8)	100% (1/1)	0.441
Child education	100% (5/5)	57.1% (4/7)	100% (2/2)	0.212
Child not with parent	33.3% (2/6)	45.5% (5/11)	100% (2/2)	0.443

The association between the presence or absence of ADHD and family factors. Fisher's Exact test comparing ADHD absent to ADHD present in one context.

Abbreviation	Full Text
Child hi risk	Perinatal problems present including very low birth weight or prematurity
Child ill	Presence of epilepsy/meningitis/head injury
Child education	Presence of very early or delayed start to school
Child not with parent	Child not living with either parent

3.4 Characteristics of the study group demonstrating co- morbidities

Table 3.4 Associations between Constructs within Conners' Questionnaires

Construct	DSM-IV ADHD Absent	DSM-IV ADHD Present	Fishers Exact Test p-value
p-odd	3/6 (50%)	3/9 (33%)	0.622
t-odd	1/6 (16.7%)	5/6 (83.3%)	0.080
p-anx	5/6 (83.33%)	8/9 (88.89%)	1.000
t-anx	4/6 (66.67%)	4/6 (66.67%)	1.000
c-anx	1/16 (6.25)	2/4 (50%)	0.088

The strength of associations between criteria was examined. Two diagnoses usually associated with ADD, viz. anxiety and ODD were ascertained from the Conners' scores.

Abbreviation	Full Text
p-odd	Conners' Parent Score oppositional defiance
t-odd	Conners' Teacher Score oppositional defiance
p-anxiety	Conners' Parent Score anxiety
t-anxiety	Conners' Teacher Score anxiety
c-anx	Conners' Child Score anxiety

The only association that showed marginal significance was that of child anxiety and a DSM-IV diagnosis of ADHD. The presence of oppositional defiance disorder (ODD) approached significance in the teacher assessment.

4.0 DISCUSSION

4.1 Summary of results

The hypothesis assumed that neurodevelopmental problems would be greater in this group of children than in the general population of non offenders. The existing body of research would support this. The findings partially support the hypothesis as developmental delays such as learning disabilities were identified in the majority of participants. A full DSM-IV diagnosis of Attention Deficit Hyperactivity Disorder was not found to be increased as expected, although the majority of participants were symptomatic. The incidence of intellectual disability was not increased in those tested. The family and environmental factors that are associated with children in conflict with the law were not increased in those with neurodevelopmental challenges.

4.2 Study limitations

There are a number of shortcomings in this study that limit its generalisation.

The numbers are too small to generalise and this is aggravated by missing data. The reduction in sample size (from 32 to 20 participants) was related to juveniles who escaped from a so called “secure unit” and whom the researcher, retention personnel and the police were unable to trace. Before the project began, the unit was identified as being suitable for the research project. Unfortunately, the high escape rate from the unit was not divulged to the researcher prior to commencing the research project. This accounts for the reduction in size of the sample which had not been anticipated. The unit was subsequently closed down due to the internal problems.

A further problem encountered was that even within the twenty participants, some data are missing. The small sample makes the analysis of the data and applicability to the broader population problematic.

The teacher response rate was suboptimal as retrieving questionnaires was more difficult than anticipated. Unfortunately eight teachers did not return the surveys and these were unobtainable despite telephone contact and visits to the schools. Due to the small numbers the prevalence of ADHD may have changed if all the teacher information was available.

The selection of subjects is non- randomised and an inherent selection bias exists because subjects who volunteer may have thought that participation would be advantageous to outcome of the court case.

The controls used for assessing attention were based on the normative data for North American children. This normative data is based on large, ethnically heterogeneous samples of over 3000 youths. Separate norms were given for those of African descent. The Conners' tool in particular has been used in many diverse research and clinical applications in both north and southern hemispheres and was considered to be most appropriate for this research project. This has limitations in that it assumes cultural neutrality or homogeneity. One would have to conclude that there is only a tentative match for South African children particularly those who are non English speakers.

Children with social risk factors, in particular those related to poverty, are more likely to have poor cognitive social and behavioural outcomes. There is also a high rate of delinquency in

siblings of delinquents (Woolfenden, 2002). As a consequence, the reliability of a control group consisting of such children was questioned. A society in transition is unstable, particularly populations in semi-rural areas and townships, which in turn would lead to problems for the research with identifying a control; in addition to this, the low socio economic status of such a group would very likely mean that there would be no incentive for them to participate in the research. This in itself was identified as a potential area for further research.

The applicability to children of diverse backgrounds is of concern. This was particularly noticeable with the PEERAMID which identified a higher number of deficits than the XSSAIS-R.

There is interaction of multiple risks that act as confounders. These were identified in this study by the use of both demographic questionnaires and standardised tools used. They included cognisance of biological, developmental, social cultural and parental factors.

Differences between primary informants – Informants were the same for all assessments, this rules out informant biases as a source of variation (Steinhausen, 2003). Different assessments tend to pick up different issues; this gives a better predictability (Silberg, 2003.) A problem with this is that multiple testing may result in chance findings.

The instruments used were selected on the basis of reviews (Collett, 2003), the requirements were that they were standardised, reliable, valid and accurate (Halfon, 2003). The Conners' rating tools met these criteria and are widely used in both the Northern and Southern

hemisphere. Most of the studies reviewed, used screening instruments that detected psychopathologies rather than neurodevelopmental deficits. The PEERAMID had been used in North American offender populations as well as non-offending children and was tested in the same age range as this study group (Levine, 1985). Allowances for ethnic differences were made in its development. This study aimed to ensure that all aspects of development were measured however, locally validated tools were not available and this study highlighted the need for such instruments.

Self-report methods are generally reliable and valid (Vermeiren, 2004). Youth self-reports did not discriminate patients from controls in ADHD. However, parent information increased the prevalence rates. Youth self-report for conduct disorder and substance abuse disorder correlate highly (Greydanus, 2005; Thomas, 2001). In conduct disorder, lying is a feature, thus reporters may tend to minimise symptoms. There is also an association with parents who may be uncooperative, anti-social and have substance abuse disorder themselves.

4.3 Discussion of Results

The objective of this study was to describe the neurodevelopmental challenges in an adolescent offender population in the Eastern Cape. It was expected that these challenges would be greater than in the non-offending population. The environmental and family factors contributing to this were also examined.

Neurodevelopmental Challenges

Attention Deficit Hyperactivity Disorder: In order to make a DSM-IV diagnosis of ADHD,

subjects require six out of nine listed inattention symptoms or six out of nine hyperactivity symptoms that should be present within two contexts and impair function. The Conners' screening tools identify the symptoms that meet the DSM-IV criteria and so correlate well with the diagnosis of ADHD (Collett, 2003).

The majority of participants were symptomatic for ADHD, but did not meet the full diagnostic criteria. Only two male and no female subjects met the full diagnostic criteria, an incidence of 10%. In a study by Barbaresi et al (2002) in Rochester, Minnesota, the incidence of ADHD was estimated in a birth cohort over a five year period. The cumulative incidence of ADHD at nineteen years ranged from 7.4% to 16%. The estimates of occurrence appear to be related to the stringency of the criteria applied. Findings in the literature have varied showing reported prevalence from 1 to 20% among school age children (American Academy of Paediatrics 2000). These studies were carried out in non-offending populations; thus the findings in this study would fit within the range of non-offending adolescents.

One would have expected a higher incidence of the diagnosis of ADHD in the offenders. A study by Karniski (1982), found a higher rate of attention deficit amongst offenders. It was thought that in particular, impulsivity symptoms were more marked than in the normal population. In the Dunedin Longitudinal study that followed a cohort of New Zealand infants through adolescence to adulthood, there was an increased likelihood of antisocial behaviour and delinquency in the presence of ADHD (Moffitt 1993). Boys with attention problems combined with conduct problems are more predisposed to adolescent delinquency (Becker & McCloskey, 2002). Taylor (2005) argues that the cumulative effect of hyperactivity in the

presence of care giving failure is more likely to lead to adverse outcomes in children with ADHD.

Attention deficit hyperactivity disorder occurs primarily in boys and there are few studies to categorically analyse gender difference in this disorder (Gaub, 1997). In a meta-analysis of eighteen studies, Gaub found that there were no gender differences in impulsivity, academic performance, social functioning, fine motor skills, parental education or parental depression. However girls with ADHD tended to have greater intellectual impairment and lower rates of externalising behaviour than boys. This study correlated with the literature in that there were fewer females who offended. Only large scale epidemiologic investigations would be able to fully address any differences.

There is some debate regarding the use of various diagnostic criteria. Some authors believe that ADHD is more accurately considered as an extreme of behaviour that varies within a population rather than as a categorical discrete disorder (Levy, 1997). This perspective is helpful with regard to the recognition of the variation in presentation. It accepts that children below the arbitrary criteria may show problematic behavioural differences. In the study by Fergusson et al (2005b) there were higher rates of ADHD in offenders and this was associated with lower IQ. These authors also make the point that the manifestations of symptoms may or may not reach the diagnostic threshold, however intervention may be required even if a full diagnosis is not made to avoid adverse outcomes.

It may be that environmental factors modulate the symptoms in certain individuals so that some parents may have a different tolerance for symptoms to others. One of the criticisms of

the screening is that there would be a difference in judgement between parents and teachers because of the requirement of different performances that different tasks demand.

A criticism of a diagnostic, or categorical approach, is that a condition is either present or absent, this is a limitation of the Conners' and other screening tools for ADHD. However, identifying symptoms which may range from non-existent to severe may have statistically confirmed the hypothesis. The STRANDS moves towards an empirical quantitative approach but as yet no approach fully satisfies all the questions related to paediatric neurodevelopmental challenges. The Conners' self-assessment scores are consistent with that expected. The authors describe adolescents, as under diagnosing their own symptoms, possibly an attempt to present themselves in a positive light (Conners, 2001). The STRANDS utilises a metacognitive theoretical model with quantitative and qualitative scoring. Its more subtle approach effectively renders a higher score relative to the potential risk of attention deficit in children. The Conners' CASS- DSMIV identified 20% (4/20) of the adolescents with a positive diagnosis of ADHD while STRANDS identified 40% (8/20) of the same population giving a self-assessment diagnosis of ADHD. The STRANDS test asks questions in a different way and children in the test will identify external loci of controls versus internal loci of controls. Those with external loci are more likely to have problems with attention deficit.

Some authors have criticised the current practice of regarding children with ADHD as an undifferentiated group. Their contention is that deficits occur in different areas of inattention (for example sustained attention and selective attention) and more comprehensive, selective testing may identify subgroups who are currently not identified (Tsal et al, 2005). This may identify a greater number of affected individuals but the tools are not yet developed and further research is necessary in this area.

Learning and Intellectual Disabilities

It is recognised that 70% of subjects with a full diagnosis of ADHD have a learning disability which may be a reading, mathematics or language disorder. It is thought that learning disability and the behavioural impairments as seen in ADHD share an impairment of working memory. This combination is also identified as a risk factor for delinquency (Brier, 1989). The combination of a learning disability and ADHD increased the risk of deviant and behavioural problems by three to four times (Dekker, 2003a).

Lower IQ and learning disabilities as identified in the Christchurch Health and Development Study, suggested that there were links between low intelligences and later conduct problems and adverse outcomes in adolescence (Fergusson, 2005b). They proposed a dual path way model that early conduct problems were a precursor of crime and that low IQ was a precursor of poor educational outcome rather than interpersonal adjustment issues. A study by Levine (1985) found that delinquent subjects tended to have clusters of impairments with educational failure at an early age. There was evidence of multiple risk factors with combinations of neurodevelopmental dysfunctions plus behaviour disorders and social, economic disadvantages. This seemed to predispose the boys to delinquency and reduced any natural resilience. Other studies confirmed an association between learning disability and delinquency especially among lower socio economic groups, Loeber & Dishion (1983) noted that at the end of primary school, low achievement, low vocabulary and poor verbal reasoning improved the prediction of delinquency by 27%. The findings of the PEERAMID confirmed the high incidence of problems with executive function and learning difficulties. The two males in the study with ADHD had developmental impairments. There was evidence of school failure with

four participants not progressing beyond grade four. The IQ testing of half the cohort did not demonstrate a significant number with low IQ as expected.

Family and Environmental factors associated with neurodevelopmental challenges:

The demographics of participants, parents together with family and health history were gathered through the administration of questionnaires designed specifically for this purpose. The associated risk factors identified were not statistically different between subjects with and without ADHD. Thus this high risk group did not statically demonstrate the environmental adversity that would predispose to conflict with the law.

Maternal risk factors were low. The questionnaire screened for depression, alcohol consumption, level of maternal education and smoking, which have all been shown to predispose to adverse outcomes and ADHD in the offspring (Taylor, 2005). The Rochester longitudinal study showed that multiple risk factors aggravate outcomes and these were a history of maternal mental disorder, high maternal anxiety, unskilled occupational status, low maternal educational status, single parenthood, stressful life events and large family size (Sameroff, 2000). This combination tended to result in problem behaviour as well as academic problems.

Factors such as child maltreatment, inter parental violence, family disruption, poverty and life stresses have all been linked with negative outcomes in children's development (Appleyard, 2004). Rutter and his colleagues (1985) identified paternal criminality, low social status and maternal mental disorder as significantly correlating with childhood pathologies.

The first five items of the demographic questionnaire relating to the child indicated whether milestones were achieved when expected and would be an indicator of failure to reach milestones and possible neurodevelopmental problems.

The age at start of school was analysed as some children started school at the age of four i.e. started school earlier than six years of age, the legal norm. This is a common practice in the townships, but leads to children being retained in classes until they catch up with their peers. This is our clinical experience but was not identified in the study. Others started school after the expected age. It is noted that either being too young or too old at the start of school may disadvantage the child (Sharp, 2002; Zill, 1997). It appears that the more risk factors there are the more disastrous their effect on later developmental outcomes and the more risk factors, the more likely that there would also be poor academic outcomes. The low level of maternal and paternal risk factors did not demonstrate any significance in the diagnosis of neurodevelopmental deficits or delinquency. Many of the studies quoted were larger, longitudinal studies which are an advantage over a small cross sectional sample.

Screening for associated psychopathologies is included in the Conners'. The incidence of externalising problems would be indicated by oppositional behaviour, a precursor to conduct disorder. In this study the ODD approached significance only in the Conners' teacher scores. In Appleyard (2004), it appeared that the more risks in early years, the more likely that there would be externalising problems at age sixteen as well as to a lesser extent, internalising problems such as anxiety. Anxiety was noted by parents in 87% (13/15) of the children, and by teachers in 66% of participants (8/12) but not identified in the self- assessment. Seventeen percent of people diagnosed with ADHD may have anxiety disorder (Mennin, 2000). In this

regard the study concurred with the findings in the literature. This result is higher than expected and the reasons for this not examined.

The neurodevelopmental challenges were not identified within the school context. As this is a risk factor for delinquency, early identification is crucial in order to minimise the risks of school failure and drift towards conflict with the law. Every risk factor that can be identified and reduced may make a difference. Recognised interventions include (Appleyard, 2005):

- Identifying at risk children and directing assistance to the family and the individual. A multi-disciplinary approach is the most effective.
- Social Services should be involved with at risk families. The entry point may be that of child maltreatment or those in receipt of child support grant. At a pre-school level, parenting interventions have proved useful.
- Health surveillance and screening have not necessarily been shown to improve health outcomes but at risk babies should be closely followed e.g. very low birth weight or complicated deliveries to anticipate problems and provide support. In a resource challenged environment, failure of referral processes or inadequate services to provide intervention often limit efficacy (Pratt, 2002).
- Medication and parental support to implement behavioural and learning strategies has been shown to be effective in management of ADD/ADHD (Daley, 2004).
- Education facilities need to identify children who are not coping at every level from pre-primary through to high school. School based programmes which assist with remediation would help those with specific learning disabilities.

5.0 CONCLUSION

The literature suggests that children are more likely to be in conflict with the law if they have neurodevelopmental challenges such as ADHD together with a low intelligence quotient, problematic social skills, language difficulties, have difficulty at school, have a parent, especially a father, who is alcohol dependent and / or criminal and a disrupted family system. The likelihood of delinquency increases as more factors are present. The objective of this research report to describe the demographics and neurodevelopmental challenges of juvenile delinquents was attained and the findings correlated to the research literature.

The majority of participants had developmental dysfunctions as demonstrated by the neurodevelopmental examination. Many were symptomatic for attention deficit although the diagnosis of ADHD was the same as for non-offenders, not increased as expected.

It appears that delinquency may be as a result of the interplay between multiple factors: biological, developmental, social, cultural, interpersonal and parenting styles. The interplay between the external environmental factors and innate personal vulnerabilities that make a child more likely to break the law were not statistically significant in this study. The combination of these factors together with some evidence of family disruption, economic disadvantage would have been consistent with findings in the literature. Surprisingly maternal risk factors, paternal criminality and absence between children with ADHD compared to those without ADHD did not reach statistical significance in this study. A larger cohort may have possibly concurred with international studies.

The difference between genders was noted in that fewer females participated in the study as they reflect fewer females than males in conflict with the law. Fewer females were symptomatic for ADHD which is consistent with the literature.

The use of various instruments in this study raised the issue of appropriate assessment tools for differing cultural groups and levels of education. The Conners' instrument is widely recognised as the gold standard for assessing DSM-IV diagnosis of ADHD but more children identified attention symptoms when questions were phrased in a less obvious way by the STRANDS than using the Conners'. The use of an IQ test in contrast to a neurodevelopmental tool demonstrated differences in outcomes with fewer participants being identified by the XSSAIS-R as having neurodevelopmental challenges.

There is a paucity of studies in South Africa on children with delinquency. Additional studies are obviously needed. The studies need to use a number of modalities to assess the presence of neurodevelopmental and or psychopathological diagnoses and these should be culturally appropriate. Clinical evaluations using epidemiological methods are required. It may be difficult to carry out these types of studies because of the resources needed. The benefit of carrying out these studies would be to influence the development of interventions in identified vulnerable children and prevent or reduce the risk of delinquency.

5.1 Further Research

An area of further research raised by this study is that of the association of high anxiety levels and presence of DSM-IV ADD. An association between the two conditions is recognised.

Psychopathologies were not ascertained by this study but it would be useful to explore this aspect further.

It would be valuable to further explore mediators and moderators of resilient or adaptive outcomes for children in high risk settings as identification would lead to better prevention and intervention programmes.

The development of culturally appropriate tools for use in the South African context or modification and validation of existing, imported tools would encourage further research in the field of neurodevelopment.

Appendix 1

Results Summary

Result Summary			Confounding Variables																													
Cohort	Age	Gender	CPRS				CTRS				CASS			PEER-AMID	STRA-NDS	IQ	Maternal				Paternal				Child							
			ADD	DSMIV	Anx	ODD	ADD	DSMIV	Anx	ODD	ADD	DSMIV	Anx				educ	age	ETOH	smok	law	ETOH	home	hirisk	delay	ill	late edu	parent				
104	13	m	79	60	54	75	82	78	71	72	63	60	72	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
105	15	m					74	82	47	60	65	52	72	0	1	1	0	0														1
106	16	m					52	62	57	54	60	61	64	0	1	1																1
107	17	m					62	57	44	45	51	49	53	0	1																	1
108	16	m	87	90	90	52	45	47	57	54	66	48	49	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	17	m	90	90	90	75	62	82	71	62	43	43	57	0	0	0	1													2	1	
110	15	f	50	58	58	44	81	85	79	74	64	54	59	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0
111	15	f					90	90	90	90	68	58	56	0	0	1																0
112	16	f									63	62	51	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
114	17	m	62	72	72	40					47	44	52	0	1		0		1	1	0	0	0						0	2	1	
115	17	m	44	62	85	44	67	56	85	76	36	41	46	0	0		1	0	0	0	0	0	0					0	1	1	0	
116	16	m	56	48	68	40	55	53	67	45	44	51	46	0	1		0		0	0		1	0	0	0	0	0	0	0	0	1	0
117	16	f	73	63	72	52					54	39	52	0	1		0	0	0	1		1	0	0	0	0	1	1	1	1	0	0
119	14	m	74	57	65	77					53	38	55		1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	16	m	73	64	90	58					51	48	57		1		1	0	0	0		1	0	1	0	0	0	0	0	0	0	0
121	15	m	74	54	90	64					56	54	44	0	0		1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0
122	16	m	49	53	65	73					60	60	50	0	1		1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
123	13	f	59	63	87	46	51	51	83	45	53	40	41	0	1	1	1	0	0	0	0		1	0	0	0	0	0	0	1	0	0
124	14	m	90	90	90	89	53	51	63	48	68	54	49	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
125	17	f	54	52	69	45					43	38	41	1	0		1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0

The extracted results for the Conners' were recorded as the T scores. The remaining scores were coded 0 if absent symptom/ diagnosis and 1 if present symptom/diagnosis.

Appendix 2 Questionnaires – Samples

Conners-Wells' Self-Report Scale (L) By C. Keith Conners, Ph.D. and Karen Wells, Ph.D.

Client ID: _____		Gender: M F		(Circle One)	
Birthdate: ____/____/____		Age: ____		School Grade: ____	
Month Day Year		Month Day Year		Today's Date: ____/____/____	
<p>Instructions: For the items below, circle the number that indicates whether the item is Not at All, Just a Little, Pretty Much, or Very Much True for you. "Not at All" means that the item is <i>seldom or never</i> a problem. "Very Much" Means that the item is <i>very often a problem</i> or occurs <i>very frequently</i>. "Just A Little" and "Pretty Much" are in between. Please respond to all the items.</p>					
	NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)	
1.	My parents' discipline is too harsh	0	1	2	3
2.	I feel like crying.....	0	1	2	3
3.	I bend the rules whenever I can	0	1	2	3
4.	I tend to learn more slowly than I would like to.....	0	1	2	3
5.	I am easily set off	0	1	2	3
6.	I cannot sit still for very long	0	1	2	3
7.	My parents only notice my bad behaviour.....	0	1	2	3
8.	I make careless mistakes or have trouble paying close attention to details...	0	1	2	3
9.	Punishment in our house is not fair	0	1	2	3
10.	I am discouraged.....	0	1	2	3
11.	I have trouble keeping my attention focused when playing or working	0	1	2	3
12.	I get into trouble with the police	0	1	2	3
13.	I have trouble organizing my schoolwork	0	1	2	3
14.	I tend to explode easily.....	0	1	2	3
15.	I have too much energy to sit still for long	0	1	2	3
16.	My parents do not reward or notice my good behaviour	0	1	2	3
17.	I have trouble listening to what people say to me	0	1	2	3
18.	My parents are too strict.....	0	1	2	3
19.	I feel sad and gloomy	0	1	2	3
20.	I have trouble finishing my schoolwork or chores.....	0	1	2	3
21.	I break rules.....	0	1	2	3
22.	I forget things that I have learned.....	0	1	2	3
23.	I have a hot temper	0	1	2	3
24.	I tend to squirm and fidget.....	0	1	2	3
25.	My parents expect too much from me	0	1	2	3
26.	I have problems organizing my tasks and activities	0	1	2	3
27.	It seems like my parents are always criticizing me.....	0	1	2	3
28.	I worry a lot about little things.....	0	1	2	3
29.	I like to hurt some people	0	1	2	3
30.	It takes a lot of effort to get my schoolwork done	0	1	2	3
31.	I lose my temper.....	0	1	2	3
32.	I feel restless inside even if I am sitting still.....	0	1	2	3
33.	Noises tend to put me off track when I am studying.....	0	1	2	3
34.	I don't like schoolwork or homework where I have to think a lot	0	1	2	3
35.	There is a lot of yelling in our house.....	0	1	2	3
36.	A lot of things scare me even if I would not admit it to others	0	1	2	3
37.	I have urges to do really bad things	0	1	2	3
38.	Sticking with things for more than a few minutes is difficult	0	1	2	3
39.	My temper gets me into trouble.....	0	1	2	3
40.	I have to get up and move around during homework.....	0	1	2	3

Conners-Wells' Self-Report Scale (L)
By C. Keith Conners, Ph.D. and Karen Wells, Ph.D.

	NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)
41. I do not have good judgment about a lot of things	0	1	2	3
42. I lose things necessary for tasks or activities (e.g. school assignments, Pencils, books, or tools)	0	1	2	3
43. The rules in our house are not very clear	0	1	2	3
44. I act okay on the outside, but inside I am unsure of myself	0	1	2	3
45. I destroy property that belongs to others	0	1	2	3
46. I have trouble keeping my thoughts organized	0	1	2	3
47. A lot of things irritate me	0	1	2	3
48. I have trouble sitting still through a meal	0	1	2	3
49. I have trouble playing or doing leisure activities quietly	0	1	2	3
50. I am distracted when things are going on around me	0	1	2	3
51. My family does not do many fun things together	0	1	2	3
52. I am afraid to be alone	0	1	2	3
53. I am forgetful in my daily activities	0	1	2	3
54. I like to do dangerous things	0	1	2	3
55. I lose track of what I am supposed to do	0	1	2	3
56. People bug me and get me angry	0	1	2	3
57. I fidget (with my hands or feet) or squirm in my seat	0	1	2	3
58. I like to be on the go rather than being in one place	0	1	2	3
59. I am behind in my studies	0	1	2	3
60. I leave my seat when I am not supposed to (e.g. in school)	0	1	2	3
61. I am not very close to my family	0	1	2	3
62. I get nervous	0	1	2	3
63. I am restless or overactive	0	1	2	3
64. I am truant from school (i.e. stayed out of school without permission)	0	1	2	3
65. I have trouble concentrating on one thing at a time	0	1	2	3
66. I still throw tantrums	0	1	2	3
67. I am a lonely person	0	1	2	3
68. Sometimes I feel like I am driven by a motor	0	1	2	3
69. I am touchy or easily annoyed	0	1	2	3
70. I am always on the go	0	1	2	3
71. My parents do not really care about me	0	1	2	3
72. The future seems hopeless to me	0	1	2	3
73. I take things that do not belong to me	0	1	2	3
74. I am very disorganized when it comes to homework	0	1	2	3
75. I talk too much	0	1	2	3
76. I have a lot of aches and pains	0	1	2	3
77. I drink alcoholic beverages	0	1	2	3
78. I read slowly and with a lot of effort	0	1	2	3
79. I give answers to questions before the questions have been completed	0	1	2	3
80. I take drugs	0	1	2	3
81. I have trouble with reading and spelling	0	1	2	3
82. I have trouble waiting in line or taking turns with others	0	1	2	3
83. My handwriting is poor	0	1	2	3
84. I lose my place when I am reading	0	1	2	3
85. I am easily lead into trouble	0	1	2	3
86. I interrupt others when they are working or playing	0	1	2	3
87. I have nightmares	0	1	2	3

Conners' Parent Rating Scale-Revised (L) **By C. Keith Conners, Ph.D.**

Child's ID: _____ **Gender:** M F (Circle One)

Birthdate: ____/____/____ **Age:** ____ **School Grade:** ____
 Month Day Year

Parent's ID: _____ **Today's Date:** ____/____/____
 Month Day Year

Instructions: Below are a number of common problems that children have. Please rate each item according to your child's behaviour in the last month. For each item, ask yourself "How much of a problem has this been in the last month?", and circle the best answer for each one. If none, not at all, seldom, or very infrequently, you would circle 0. If very much true, or it occurs very often or frequently, you would circle 3. You would circle 1 or 2 for ratings in between. Please respond to all the items.

	NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)
1. Angry and resentful	0	1	2	3
2. Difficulty doing or completing homework	0	1	2	3
3. Is always "on the go" or acts as if driven by a motor	0	1	2	3
4. Timid, easily frightened	0	1	2	3
5. Everything must be just so	0	1	2	3
6. Has no friends	0	1	2	3
7. Stomach aches.....	0	1	2	3
8. Fights.....	0	1	2	3
9. Avoids, expresses reluctance about, or has difficulty engaging in tasks that require sustained mental effort (such as schoolwork or homework)	0	1	2	3
10. Has difficulty sustaining attention in tasks or play activities	0	1	2	3
11. Argues with adults	0	1	2	3
12. Fails to complete assignments	0	1	2	3
13. Hard to control in malls or while grocery shopping.....	0	1	2	3
14. Afraid of people	0	1	2	3
15. Keeps checking things over again and again.....	0	1	2	3
16. Loses friends quickly	0	1	2	3
17. Aches and pains.....	0	1	2	3
18. Restless or overactive	0	1	2	3
19. Has trouble concentrating in class	0	1	2	3
20. Does not seem to listen to what is being said to him/her	0	1	2	3
21. Loses temper.....	0	1	2	3
22. Needs close supervision to get through assignments	0	1	2	3
23. Runs about or climbs excessively in situations where it is inappropriate	0	1	2	3
24. Afraid of new situations	0	1	2	3
25. Fussy about cleanliness	0	1	2	3
26. Does not know how to make friends	0	1	2	3
27. Gets aches and pains or stomach aches before school.....	0	1	2	3
28. Excitable, impulsive.....	0	1	2	3
29. Does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)	0	1	2	3
30. Has difficulty organizing tasks and activities	0	1	2	3
31. Irritable	0	1	2	3
32. Restless in the "squirmy sense"	0	1	2	3
33. Afraid of being alone	0	1	2	3
34. Things must be done the same way every time	0	1	2	3
35. Does not get invited over to friends' houses	0	1	2	3
36. Headaches	0	1	2	3
37. Fails to finish things he/she starts	0	1	2	3

Conners' Parent Rating Scale-Revised (L)
By C. Keith Conners, Ph.D.

	NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)
38. Inattentive, easily distracted	0	1	2	3
39. Talks excessively	0	1	2	3
40. Actively defies or refuses to comply with adults' requests	0	1	2	3
41. Fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities.....	0	1	2	3
42. Has difficulty waiting in lines or awaiting turn in games or group situations	0	1	2	3
43. Has a lot of fears	0	1	2	3
44. Has rituals that he/she must go through.....	0	1	2	3
45. Distractibility or attention span a problem	0	1	2	3
46. Complains about being sick even when nothing is wrong.....	0	1	2	3
47. Temper outbursts	0	1	2	3
48. Gets distracted when given instructions to do something	0	1	2	3
49. Interrupts or intrudes on others (e.g. butts into others' conversations or games)	0	1	2	3
50. Forgetful in daily activities	0	1	2	3
51. Cannot grasp arithmetic	0	1	2	3
52. Will run around between mouthfuls at meals	0	1	2	3
53. Afraid of the dark, animals, or bugs.....	0	1	2	3
54. Sets very high goals for self	0	1	2	3
55. Fidgets with hands or feet or squirms in seat.....	0	1	2	3
56. Short attention span	0	1	2	3
57. Touchy or easily annoyed by others.....	0	1	2	3
58. Has sloppy handwriting	0	1	2	3
59. Has difficulty playing or engaging in leisure activities quietly	0	1	2	3
60. Shy, withdrawn	0	1	2	3
61. Blames others for his/her mistakes or misbehaviour.....	0	1	2	3
62. Fidgeting.....	0	1	2	3
63. Messy or disorganised at home or school.....	0	1	2	3
64. Gets upset if someone rearranges his/her things.....	0	1	2	3
65. Clings to parents or other adults	0	1	2	3
66. Disturbs other children	0	1	2	3
67. Deliberately does things that annoy other people	0	1	2	3
68. Demands must be met immediately – easily frustrated.....	0	1	2	3
69. Only attends if it is something he/she is very interested in.....	0	1	2	3
70. Spiteful or vindictive	0	1	2	3
71. Loses things necessary for tasks or activities (e.g. school assignments, pencils, books, tools or toys).....	0	1	2	3
72. Feels inferior to others.....	0	1	2	3
73. Seems tired or slowed down all the time.....	0	1	2	3
74. Spelling is poor.....	0	1	2	3
75. Cries often and easily	0	1	2	3
76. Leaves seat in classroom or in other situations in which remaining seated is expected	0	1	2	3
77. Mood changes quickly and drastically	0	1	2	3
78. Easily frustrated in efforts.....	0	1	2	3
79. Easily distracted by extraneous stimuli	0	1	2	3
80. Blurts out answers to questions before the questions have been completed.....	0	1	2	3

Demographic Questionnaires

PLEASE RETURN COMPLETED QUESTIONNAIRE

Instruction

CODE _____

Please could you answer the following questions that relate to you and your child.

All information will be treated as confidential.

Family Information

Your relationship to the child : *Mother* _____ *Father* _____ *Grandmother* _____ *Other* _____

The area / suburb where the child lives : _____

Are the child's parents : *Married* _____ *Separated* _____ *Divorced* _____ *Deceased* _____

How many brothers & their ages : *Number* _____ *Ages* _____

How many sisters & their ages : *Number* _____ *Ages* _____

Who else lives in same home as child : _____

Information about the Child's Mother

Her age when child was born : _____

Her level of education : _____

Does she live with the child : *Yes* _____ *No* _____ *Don't know* _____

Is she employed : *Full time* _____ *Part time* _____ *Unemployed* _____ *Don't know* _____

What are her sources of income : *Grant* _____ *Job* _____ *Maintenance* _____ *Don't know* _____

Please circle most appropriate answer	Not true at all (Never)	Just a little true Occasionally	Pretty much true (Often)	True (Always)	Don't know
She has serious health problems	0	1	2	3	
She drinks alcohol	0	1	2	3	
She smokes cigarettes	0	1	2	3	
She smokes dagga	0	1	2	3	
She has been a victim of violence	0	1	2	3	
She has been in conflict with the law	0	1	2	3	
She has had convictions	0	1	2	3	
She had depression after child's birth	0	1	2	3	

CODE _____

Information about the Child's Father

His age when child was born : _____

His level of education : _____

Does he live with the child : Yes _____ No _____ Don't know _____

Is he employed : Full time _____ Part time _____ Unemployed _____

What are his sources of income : Grant _____ Job _____ Maintenance _____

Please circle most appropriate answer	Not true at all (Never)	Just a little true Occasion ally	Pretty much true (Often)	True (Always)	Don't know
He has serious health problems	0	1	2	3	
He drinks alcohol	0	1	2	3	
He smokes cigarettes	0	1	2	3	
He smokes dagga	0	1	2	3	
He has been a victim of violence	0	1	2	3	
He has been in conflict with the law	0	1	2	3	
He has had convictions	0	1	2	3	

PREGNANCY & BIRTH	3.1.1.1 Yes	No	Don't know
Planned			
High blood pressure			
Early delivery			
Difficult delivery			
Normal delivery			
Forceps delivery			
Vacuum delivery			
Caesar / operation			
Birth weight	kgs		
Breast fed			
Bottle fed			
Feeding problems			
Baby in ICU			
Jaundice in baby			
Birth defects noted			

CODE _____

DEVELOPMENT	Never	0 –3 mths	4-6 mths	7-12 mths	13- 18 mths	19- 24 mths	2-3 years	3-4 years	4-5 years	Since 5 yrs
Sat										
Crawled										
Walked										
Single words										
Toilet trained										
Attended crèche										
Started school										

HEALTH PROBLEMS	Never	0 –6 mths	7-12 mths	13-36 mths	4-5 years	6-12 years	13+ years	Don't know
Ear problems								
Meningitis								
Seizures (fits)								
Pneumonia								
Asthma								
Slow or poor weight gain								
Trouble with eyes or vision								
Stayed in hospital								
Operations								
Head injuries								
Other injuries								
Allergies								
Lead poisoning								
Other poisoning or overdose								
Anaemia low blood count								
Heart problems								
TB								
HIV								
Suicide attempt								
Sexual abuse/ rape								

The Neurodevelopmental Examination
PEERAMID 2
(Paediatric Examination of Educational Readiness at Middle Childhood)
Dr M Levine and Dr A Sandler

The neurodevelopmental examination is an assessment designed to be administered by health care professionals. The PEERAMID 2 is for children between the ages of 9 and 16. It is designed to provide standardised observation procedures-techniques that can be applied to help characterize children's functional health and its relationship to their neurodevelopmental and physical status. The PEERAMID 2 is particularly sensitive to subtle developmental dysfunctions of junior high school students.

The child's performance is assessed on 32 tasks in specific areas of development: fine motor function

Language including higher language abilities

gross motor function

attention ratings

behavioural observations.

formal assessments of memory functions.

Rating systems are provided for the use of strategies, for attention and for behaviour and affect.

Psychometric Assessment
Individual Scale for Xhosa –Speaking Pupils (XSSAIS)
Human Science Research Council

The Scale was constructed to measure developmental intelligence. The scale provides a profile of subject's intelligence. It comprises the following tests: Vocabulary, Comprehension, Verbal Reasoning, Problems, Memory, Pattern Completion, Block Designs, Absurdities, Form Board and Mazes. The first five tests constitute the verbal IQ scale whilst the last five constitute the Performance Scale. It is based on the Senior South African Individual Scale-Revised (1991). It has been standardized for learners between 9 years and 19 years.

Conners' Teacher Rating Scale-Revised (L)
By C. Keith Conners, Ph.D.

Child's ID: _____ Gender: **M** **F**
(Circle One)

Birthdate: ____/____/____ Age: ____ School Grade: ____
Month Day Year

Teacher's ID: _____ Today's Date: ____/____/____
Month Day Year

Instructions: Below are a number of common problems that children have in school. Please rate each item according to how much of a problem it has been in the last month. For each item, ask yourself "How much of a problem has this been in the last month?", and circle the best answer for each one. If none, not at all, seldom, or very infrequently, you would circle 0. If very much true, or it occurs very often or frequently, you would circle 3. You would circle 1 or 2 for ratings in between. Please respond to all the items.

NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)
--	--	--	---

1. Defiant	0	1	2	3
2. Restless in the "squirmy" sense	0	1	2	3
3. Forgets things he/she has already learned	0	1	2	3
4. Appears to be unaccepted by group	0	1	2	3
5. Feelings easily hurt	0	1	2	3
6. Is a perfectionist	0	1	2	3
7. Temper outbursts; explosive, unpredictable behaviour	0	1	2	3
8. Excitable, impulsive	0	1	2	3
9. Fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities	0	1	2	3
10. Sassy	0	1	2	3
11. Is always "on the go" or acts as if driven by a motor	0	1	2	3
12. Avoids, expresses reluctance about, or has difficulties engaging in tasks that require sustained mental effort (such as schoolwork or homework) .	0	1	2	3
13. Is one of the last to be picked for teams or games	0	1	2	3
14. Is an emotional child	0	1	2	3
15. Everything must be just so	0	1	2	3
16. Restless or overactive	0	1	2	3
17. Fails to finish things he/she starts	0	1	2	3
18. Does not seem to listen to what is being said to him/her	0	1	2	3
19. Actively defies or refuses to comply with adults' requests	0	1	2	3
20. Leaves seat in classroom or in other situations in which remaining seated is expected	0	1	2	3
21. Poor in spelling	0	1	2	3
22. Has no friends	0	1	2	3
23. Timid, easily frightened	0	1	2	3
24. Keeps checking things over and over	0	1	2	3
25. Cries often and easily	0	1	2	3
26. Inattentive, easily distracted	0	1	2	3
27. Has difficulty organizing tasks or activities	0	1	2	3
28. Has difficulty sustaining attention in tasks or play activities	0	1	2	3
29. Has difficulty waiting his/her turn	0	1	2	3
30. Not reading up to par	0	1	2	3

Conners' Teacher Rating Scale-Revised (L)
By C. Keith Conners, Ph.D.

	NOT TRUE AT ALL (Never, Seldom)	JUST A LITTLE TRUE (Occasionally)	PRETTY MUCH TRUE (Often, Quite a Bit)	VERY MUCH TRUE (Very often, Very Frequent)
31. Does not know how to make friends	0	1	2	3
32. Sensitive to criticism.....	0	1	2	3
33. Seems over-focused on details	0	1	2	3
34. Fidgeting.....	0	1	2	3
35. Disturbs other children	0	1	2	3
36. Talks excessively	0	1	2	3
37. Argues with adults	0	1	2	3
38. Cannot remain still.....	0	1	2	3
39. Runs about or climbs excessively ins situations where it is inappropriate0	0	1	2	3
40. Lacks interest in schoolwork	0	1	2	3
41. Has poor social skills.....	0	1	2	3
42. Has difficulty playing or engaging in leisure activities quietly	0	1	2	3
43. Likes everything neat and clean.....	0	1	2	3
44. Fidgets with hands or feet or squirms in seat.....	0	1	2	3
45. Demands must be met immediately – easily frustrated.....	0	1	2	3
46. Blurts out answers to questions before the questions have been completed.....	0	1	2	3
47. Spiteful or vindictive	0	1	2	3
48. Short attention span	0	1	2	3
49. Loses things necessary for tasks or activities (e.g. school assignments, pencils, books, tools, or toys).....	0	1	2	3
50. Only pays attention to things he/she is really interested in	0	1	2	3
51. Shy, withdrawn	0	1	2	3
52. Distractibility or attention span a problem	0	1	2	3
53. Things must be done the same way every time	0	1	2	3
54. Mood changes quickly and drastically	0	1	2	3
55. Interrupts or intrudes on others (e.g. butts into others' conversations or games)	0	1	2	3
56. Poor in arithmetic	0	1	2	3
57. Does not follow through on instructions and fails to finish schoolwork (not due to oppositional behaviour or failure to understand instructions). 0	0	1	2	3
58. Easily distracted by extraneous stimuli	0	1	2	3
59. Restless, always up and on the go.....	0	1	2	3

Appendix 3

STRANDS

STUDENT QUESTIONNAIRE

Your name _____ Date _____

Gender _____ Grade in school _____ Age _____ Date of Birth: _____

School _____

(Double click on front page of STRANDS to fully open questionnaire)

STRANDS Student Questionnaire Xhosa Translation

3

Nceda uphendule le mibuzo ilandelayo ngokunyanisekileyo. Akukho mpendulo ilungileyo/engalungileyo.

Qiniseka uphendula yonke imibuzo. Enkosi.

isigaba sokuqala

UBUGCISA BESIKOLO *Nceda uziqhathanise ngokwezintlu zobugcisa, wena nabanye abafundi. Ecaleni koluhlu ngalunye kukho ibhokisi, phawula leyo ekufaneleyo.*

		5	4	3	2	1
CODE	INTHETO	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR
RD 1	Ukufunda amagama lula nangokukhawuleza.					
RD 2	Ukufunda iincwadi ngokukhawuleza.					
RD 3	Ukuqonda ulwimi incwadi ebhalwe ngalo.					
RD 4	Ukuphendula imibuzo ngebali endilifundileyo.					
RD 5	Ukufumana amabakala abalulekileyo, neembono ngoko ndikufundayo.					
RD 6	Ukuqashisela intsingiselo yomhobe.					
RD 7	Ukushwankathela/kuphinda endikufunileyo ngawam amazwi.					
RD 8	Ukuzonwabisa ngokufunda.					
WR 1	Ukubhala kakule nangokucacileyo, abanye bakwazi ukufundo oko ndikubhalileyo.					
WR 2	Ukubhala ngokukhawuleza.					
WR 3	Ukuseenzisa igrama eyiyo xa ndibhala.					

4 UBUGCISA BESIKOLO

		5	4	3	2	1
CODE	INTHETO	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR
WR 4	Ukukhumbula ukusebenzisa iziphawuli xa ndibhala e.g. ikoma.					
WR 5	Ukubhala iimbono zam ngendlela ecwangcisaweyo.					
WR 6	Ukulungisa nokuhlela ukubhala kwam ngendlela yokukuphucula.					
WR 7	Ukuhlenga hlengisa kakuhle amagama.					
WR 8	Ukubizela amagama ngokuchanekileyo.					
MA 1	Ukukhumbula amabalala athile kwizibalo (Math).					
MA 2	Ukuqonda izibakala ezitsha kwizibalo (Math).					
MA 3	Ukufunda imithetho emitsha kwizibalo (Math).					
MA 4	Ukukwazi ukuphawula nokufunda imizobo ye geometry.					
MA 5	Ukugqiba iTest yezibalo (math) ngexesha elililo.					
MA 6	Ukuqonda inkcazelo ngezibalo (Math).					
MA 7	Ukuxazulula ingxaki zamagama kwizibalo.					
MA 8	Ukonwabela izibalo.					

Total RD: _____ Total WR: _____ Total MA: _____.

Total Raw Score for SCHOOL SKILLS: _____.

isigaba sesihlanu

IZIZATHU

Le ngxenye ilandelayo yeQuestionnaire ichaza ezinto ezintathu ezino kwenzeka esikolweni, kwaye ikubuze imibuzo malunga nezizathu onazo kukucacisa ukuba kutheni ezizinto zisenzeka. Zama kangangoko ukugafihlisi, nokuyaniseka kwiimpendulo zakho. Enkhosi!

UMZEKELO 1

Umfundi unokuqhuba kakubi esikolweni ngezizathu ezahlukeneyo. Yenza ngathi ukubhala uviwo kwiveki ephelileyo kwaye ufumene iziphumo zakho. Ufumanisa ukuba uqhube kakubi kulo. Kulo luhlu lungezantsi kudweliswe ezinye ezinokuba zizizathu zokqhuba kakubi kwakho. Nceda fundisisa isizathu ngasinye, uphawule amaxa othi ucinge njalo. (phawula ibhokisi ibenye)

		4	3	2	1
CODE	WHAT YOU COULD BELIEVE OR THINK	I'D OFTEN THINK THAT	I'D SOMETIMES THINK THAT	I'D MOST NEVER THINK THAT	I'D NEVER THINK THAT
AF 1	Anzizho krele-krele ngokwaneleyo.				
AF 2	Ibiluviwo olunzima kakhulu.				
AF 3	Ibilusuku lelishwa kum.				
AF 4	Akhange ndifunde nzima ngokwaneleyo.				
AF 5	Nokuba ndinolwazi kakhulu andiqhubi kakuhle kwimvwo.				
AF 6	Iitishala zisoloko zisinika iiTest nomsebenzi onzima.				

UMZEKELO 2

Ngoku ke yenza ngathi ufumene u A kwi Report kwisifundo esinzima obusibhalile. Ngezantsi zezinye zezizathu ezingaba zizo ezenze wenze kakuhle ngoku. Nceda funda isizathu ngasinye, phawula maxa mangaphi othi ucinge ngolohlobo. (Phawula ibhokisi ibenye)

		4	3	2	1
CODE	WHAT YOU COULD BELIEVE OR THINK	I'D OFTEN THINK THAT	I'D SOMETIMES THINK THAT	I'D MOST NEVER THINK THAT	I'D NEVER THINK THAT
AS 1	Ndibe nenhlahla ngelixesha.				

13 IZIZATHU

		4	3	2	1
CODE	WHAT YOU COULD BELIEVE OR THINK	I'D OFTEN THINK THAT	I'D SOMETIMES THINK THAT	I'D MOST NEVER THINK THAT	I'D NEVER THINK THAT
AS 2	Ndisebenze nzima kunesiqhelo.				
AS 3	Xa ndithanda, ndinokwenza kakuhle.				
AS 4	Utishala wam ebelungile kakhulu.				
AS 5	Ngokuqinisekileyo wonke ubani wenze kakuhle .				
AS 6	Nziya izwazi ukubhala iReport entile.				

UMZEKELO 3

Masithi ufunde isahluko njenge ngxenye yesincoko kwaye unengxaki yokusiqonda. Nceda ufunde ingcaciso nganye engezantsi, phawula amatyeli othi ucinge ngawo ngolohlobo. (Phawula ibhokisi ibenye).

		4	3	2	1
CODE	WHAT YOU COULD BELIEVE OR THINK	I'D OFTEN THINK THAT	I'D SOMETIMES THINK THAT	I'D MOST NEVER THINK THAT	I'D NEVER THINK THAT
AC 1	Bendidiniwe okanye ndingenamgqaliselo ngokwaneleyo.				
AC 2	Isahluko besinzima kumntu wonke.				
AC 3	Ibilusuku olubi kum.				
AC 4	Utishala ebefanele ukusi cacisela.				
AC 5	Andikho krele-krele ngokwaneleyo.				
AC 6	Ndnwngxaki nesisifundo.				

Total AF: _____ Total AS: _____ Total AC: _____.

Total Raw Score for REASONS:

Appendix 4

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

R14/49 Klopper

CLEARANCE CERTIFICATE

PROTOCOL NUMBER M050806

PROJECT

The Neurodevelopmental Profiles of
Xhosa Speaking Children in Conflict with
the Law

INVESTIGATORS

Dr A Klopper

DEPARTMENT

Psychiatry/Neurosciences

DATE CONSIDERED

05.08.26

DECISION OF THE COMMITTEE*

Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 05.10.20

CHAIRPERSON



(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof Holford

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

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